



88071664

RECLAMATION REPORT

ORPHAN MINE

GRAND CANYON NATIONAL PARK, ARIZONA

by

Moon Hom
Mining EngineerU.S. DEPARTMENT OF INTERIOR
Bureau of Land Management
Phoenix District Office
Division of Mineral Resources

June 1986

TN
490
.U7
H66
1986

[illegible]

RECLAMATION REPORT - ORPHAN MINE
GRAND CANYON NATIONAL PARK, ARIZONA

TN
490
.47
H66
1986

INTRODUCTION

The Orphan Mine is located on the South Rim of the Grand Canyon approximately halfway between Hopi Point and Maricopa Point and near the Powell Memorial (Figure 1). This location is approximately two miles west of the Grand Canyon Village. The mine was worked as a copper mine and then as a uranium mine during different time periods since it was first patented. Based on a public law passed in 1962, the current mine site will be acquired by the National Park Service at the end of May 1987. In anticipation of this acquisition, personnel from the U.S. Bureau of Land Management (BLM) surveyed the mine site in order to develop abandonment and reclamation recommendations.

HISTORICAL BACKGROUND

The Orphan lode claim covering approximately 20.3 acres was patented in 1906 for copper mineralization contained in a breccia pipe structure situated approximately 1100 feet below the South Rim of the Grand Canyon National Park (Figure 2). The mining activities that occurred on the Orphan lode claim came to be known as the Orphan Mine. Copper mining occurred at the Orphan at various times during the period from 1906 to 1946. In 1953, after the discovery of uranium, the mineral rights were leased and later acquired (both estates) by a subsidiary of Western Gold and Uranium Inc., later renamed Western Equities, Inc.

Western Gold built in 1956 an aerial tramway from the adit area to the rim in order to facilitate the removal of uranium ore. From 1956 to 1959, production averaged 1000 tons per month of 1.00% U₃O₈ from mining faces at four different levels below the adit. In addition to the construction of the aerial tramway, the company constructed offices, storage buildings, and living quarters along with a water tank. The cabins and Grand Canyon Inn shown on Figure 2 were built by the previous claim owner.

Production was expanded in late 1959 by the construction of 2½ compartment shaft (two 5 foot by 5 foot hoisting compartments and a 3 foot by 5 foot manway). The shaft was collared with concrete and utilized steel sets and fireproof wooden lagging. The shaft was driven to a depth of approximately 1600 feet below the elevation of the rim. A 1200 foot horizontal drift was then driven from the 1500 foot level of the shaft to the 400 foot level of the existing workings in the adit area (Figure 3). The first ore was hoisted through the shaft in November 1959 and, shortly thereafter, the shaft became the primary haulage system of ore, men, and materials to and from the active mining area. Production in 1960 was at an average rate of approximately 6400 tons per month of 0.30% U₃O₈. Most of the ore was transported by truck to the Tuba City mill for further processing. Ore was also shipped by railroad to a uranium mill in Grants, NM.

LIBRARY

JUL 24 2003

Bureau Of Reclamation
Reclamation Service Center

2861 1986
H66
490
TN

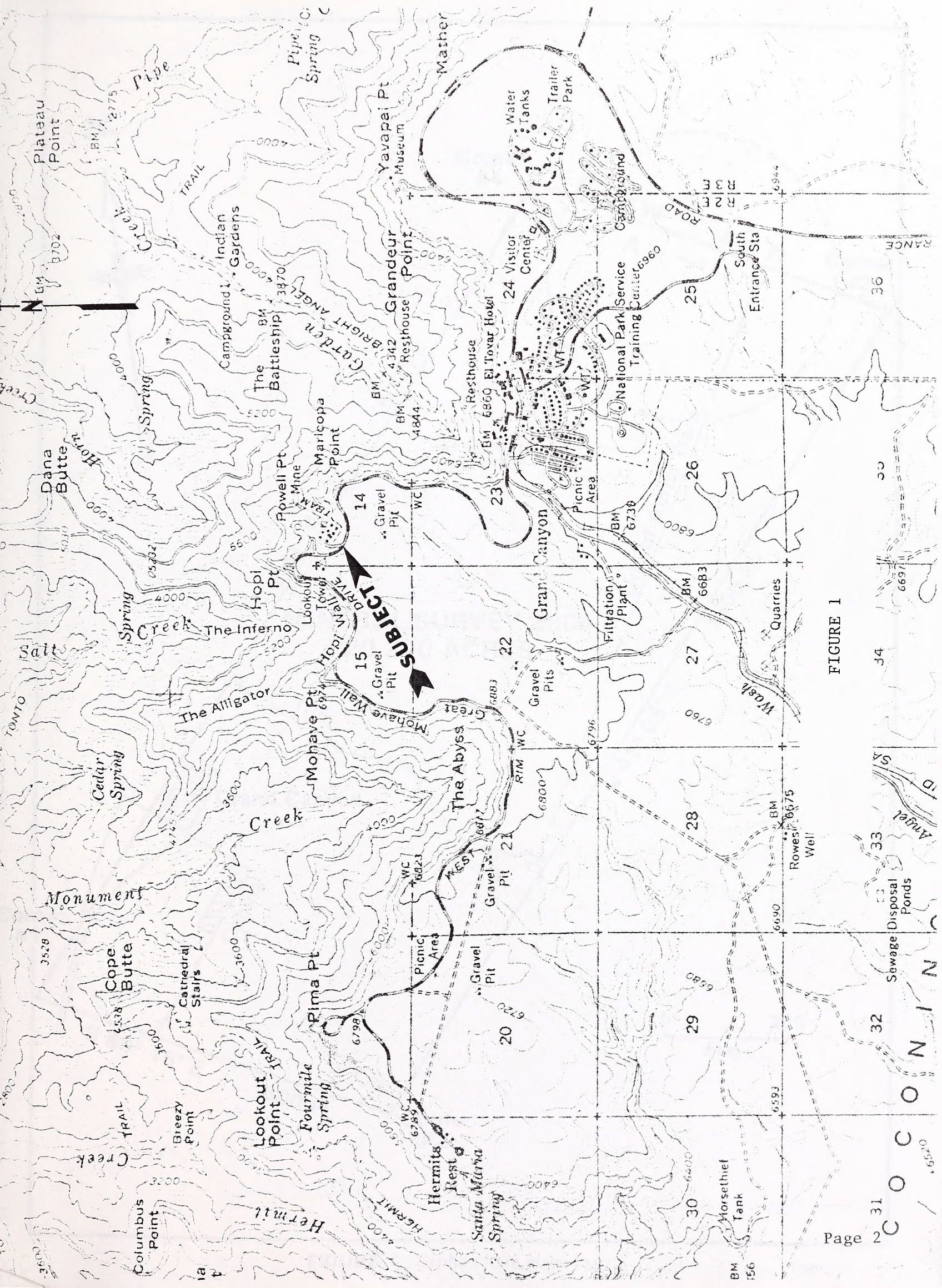


FIGURE 1

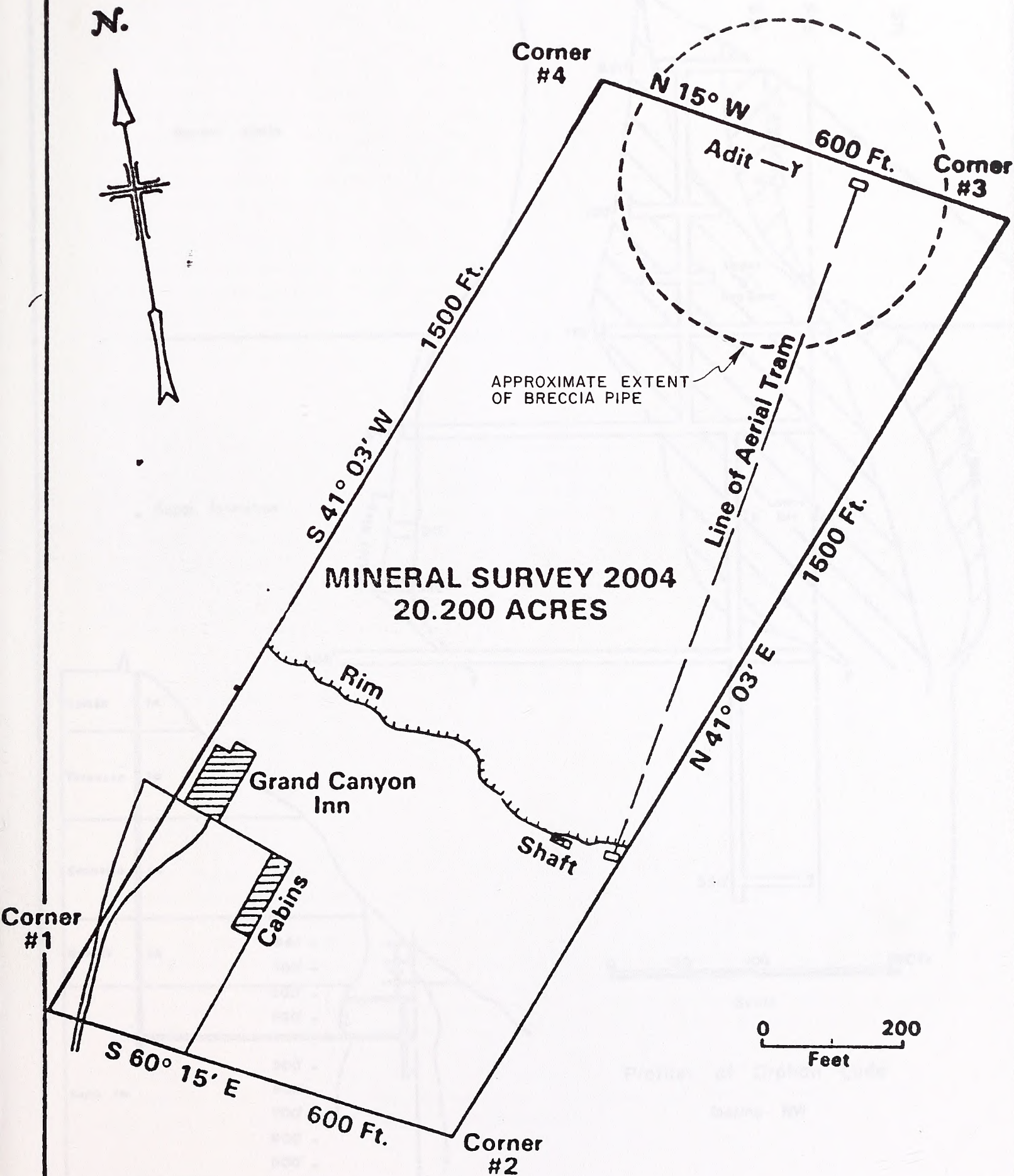


FIGURE 2 Orphan lode claim map

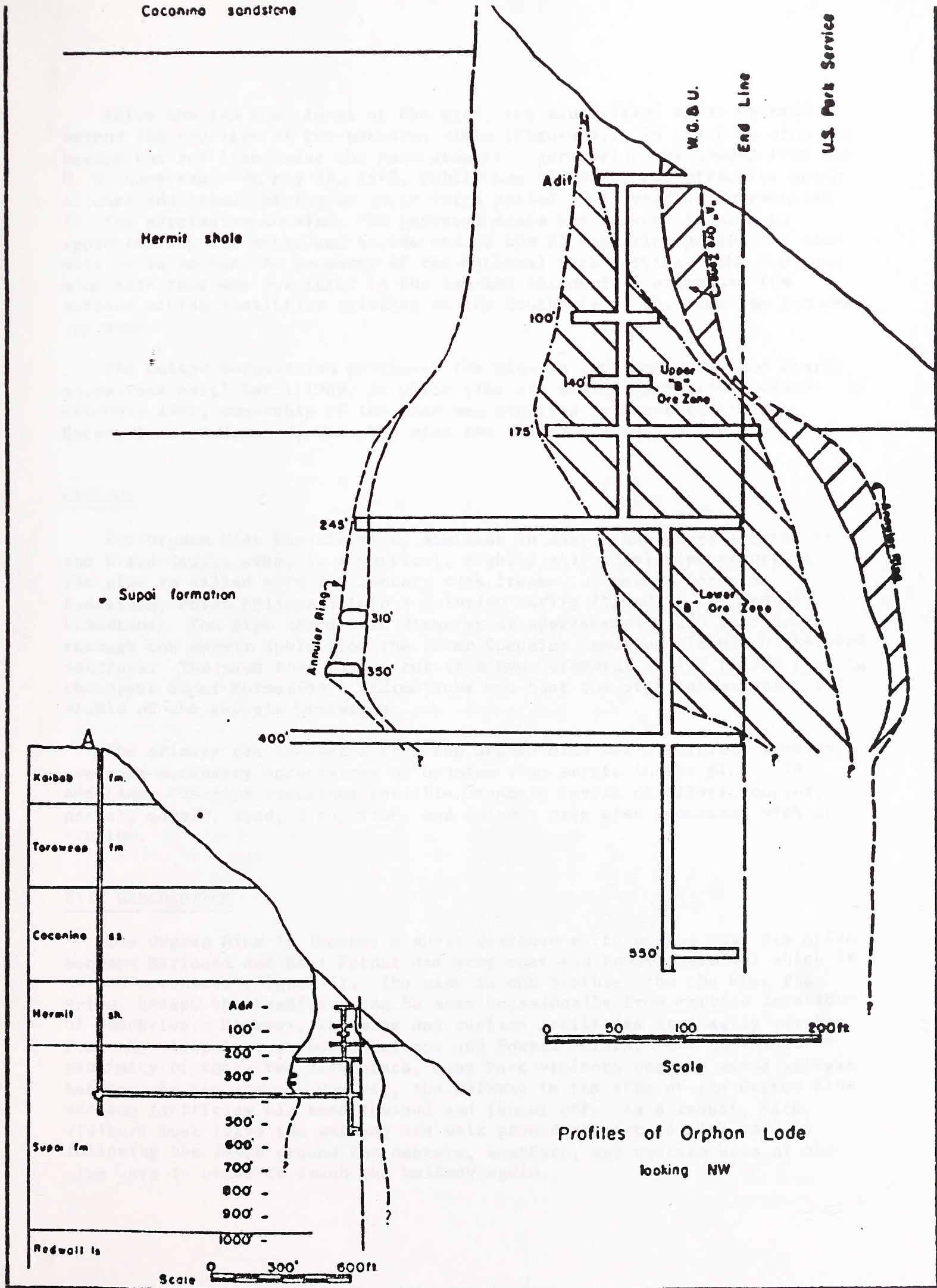


Figure 3 Orphan Lode Coconino County, Arizona

Below the 175 foot level of the mine, the mineralized zones extends beyond the end line of the patented claim (Figure 3). In order to mine ore beyond the end line under the Park property, permission was needed from the U. S. Congress. On May 28, 1962, Public Law 87-457 became effective which allowed additional mining to occur for a period of 25 years. In exchange for the permission to mine, the patented claim was reduced in size to approximately 3.0 acres and at the end of the 25 year time period the mine site would become the property of the National Park Service. The 3.0 acre mine site that was specified in the law was intended to encompass the surface mining facilities existing on the South Rim at the time the law was approved.

The Cotter Corporation purchased the mine in 1967 and continued mining operations until April 1969, at which time all mining operations ceased. In February 1981, ownership of the mine was acquired by Republic Mining Enterprises of Redmond, WA. The mine has remained closed since 1969.

GEOLOGY

The Orphan Mine breccia pipe, similiar to many other pipes located in the Grand Canyon area, is a vertical, sightly elliptical pipe structure. The pipe is filled with sedimentary rock fragments, mainly Coconino Sandstone, which collapsed into a solution cavity formed in the Redwall Limestone. The pipe has a mean diameter of approximately 230 feet down through the Hermit Shale from the lower Coconino Sandstone in which the pipe outcrops. The pipe then flares out to a mean diameter of 400 to 500 feet in the upper Supai Formation. Indications are that the pipe bottoms near the middle of the Redwall Limestone.

The primary ore recovered from the Orphan Mine was uraninite, however, numerous secondary occurrences of uranium also exists in the pipe. In addition, the pipe contained possible economic levels of silver, copper, nickel, cobalt, lead, zinc, iron, and sulphur ores when recovered with the uranium.

SITE DESCRIPTION

The Orphan Mine is located a short distance north of the West Rim Drive between Maricopa and Hopi Points and very near the Powell Memorial which is to the northwest (Figure 1). The mine is not visible from the West Rim Drive, except the headframe can be seen occasionally from certain locations of the Drive. However, the mine and surface facilities are easily visible from the viewpoints at both Maricopa and Powell Points. Due to the close proximity of these two viewpoints, many Park visitors use the paved walkway between the two areas. However, the walkway in the area of the Orphan Mine surface facilities has been removed and fenced off. As a result, Park visitors must leave the walkway and walk around the fenced mine yard by following the fence around the eastern, southern, and western ends of the mine yard in order to reach the walkway again.

The 6 foot chain link fence delineates the 3.0 acre area reserved to the patented claim holder as required by Public Law 87-457. The northern extent of the reserved area lies beyond the edge of the South Rim, however, because of the rugged terrain below the rim the northern boundary was never fenced. Apparently, over the years as a result of curious Park visitors, a short section of the fence adjacent to the main gate leading into the mine yard has had its anchor bolts removed from one support post and, therefore, many Park visitors have entered onto the private property by stepping over the chain link fence.

The mine yard contained all of the support facilities for the mining operation. The headframe stands as the most prominent structure at the mine. The approximately 80 foot tall structure is located near the foundation of the original aerial tramway near the northeast corner of the fenced area. In addition to the headframe, the support facilities currently consists of 7 corrugated metal buildings, numerous foundations of previously standing buildings, water and septic tanks, ore storage pads, and various concrete and asphalt pads. The metal buildings had been used for such purposes as housing the mine hoist, the mine air compressor, maintenance shops, supplies and material storage, and offices. The mine yard appears to have been backfilled with some material from the mine in order to have a level working area.

A large water tank is located outside of the fenced area adjacent to the dirt road leading to the main gate from the West Rim Drive and a smaller secondary tank is located just off the edge of the rim near the northwest corner of the mine yard. The concrete septic tanks are located off the edge of the rim near the aerial tramway foundation. It also appears that two underground fuel storage tanks may still be located near the center of the mine yard.

After the mine was shutdown in April 1969, the Cotter Corporation removed all useable equipment and materials. The remaining equipment is either too large, such as the hoist drum and motors, to be easily removed or may be unuseable without extensive overhaul, such as the compressor. In addition, other miscellaneous equipment and materials still remain at the mine site today. These items, such as old mine ventilation ducts and electrical transformers, apparently have very little residual value.

The surface disturbance in the area of the breccia pipe is confined to an area that is smaller than the mine yard. The most prominent feature in this area is the open hole, approximately 30 feet in diameter and 200 to 300 feet in depth, that resulted when the surface subsided into the old underground mine workings. The adit is located on the western edge of the opening. The open hole appears to be getting larger at the surface. This is due to the fact that loose unconsolidated material that surrounds the hole on the down slope is being washed into the opening or material is sloughing off the slope of the opening into the hole at other times.

Other features located in the adit area include two small wooden bunkhouses (approximately 10 feet by 12 feet in size each) and the remains of a third wooden structure, the wooden foundation of the aerial tramway, a

small waste dump, mine workings, and a small amount of discarded mining equipment and debris.

The mine workings consists of a covered raise leading into the underground mine workings very near the open hole and three adits with one being adjacent to the covered raise. Two other adits are situated near the bunkhouses which are approximately 150 feet higher in elevation than the open hole. These two adits have been driven into the contact between the Coconino Sandstone and the Hermit Shale. The first of the two adit has had the bottom half bulkheaded off. As a result, a pool has been formed by the seepage of water through the sandstone. The remains of a piping system leading to the underground mine workings is apparent and the pool was probably a water source for the mine. The other adit, approximately 3 feet in height, is open and has a small amount of water seepage on the floor. No attempt was made to determine the length of either adit. A small diameter pipe, approximately 1.5 inches in size, protruding about 1 foot from the sandstone between the two adits was dripping water. A water sample was taken and analyzed to determine water quality. The results are discussed in Recommendation Number 6 and shown in Tables 2 and 3.

Finally, the structures that remain are the two intermediate support towers for the aerial tramway that had been put in place in order for the tramway to accommodate the terrain. The towers are constructed with wooden beams and are cantilevered out into the Canyon at locations where the terrain changes sharply. The upper of the two towers is located at the top of the Coconino Sandstone and the second tower is located approximately halfway down the Coconino Sandstone. The condition of these towers, which are anchored with concrete into the sandstone, could not be determined without a closer inspection. The steel tramway cable is still strung from just below the rim to the return tower at the adit area.

ABANDONMENT AND RECLAMATION RECOMMENDATIONS

As the deadline approaches for the National Park Service to receive control of the Orphan Mine property, thought must be given to what remedial action must be taken to minimize or mitigate any residual impacts from past mining activities. Due to the type of mineralization that was mined at the Orphan, the main impact to the local mine site area is the radiological contamination. In addition, the safety and visual impacts from the deteriorating condition of the mine facilities and structures must be taken into account. Therefore, proper abandonment and reclamation of the mine and mine yard is necessary in order to limit any hazardous situations to future Park visitors.

In order to develop recommendations for the proper abandonment and reclamation of the Orphan Mine site, representatives of the Bureau of Land Management with experience in mining and the reclamation of uranium mines, have inspected the area on a number of occasions during the past year and a half. The inspections were conducted for the purpose of gathering information on the current condition of the mine and to inventory equipment

LIBRARY

JUL 24 2003

Bureau Of Reclamation
Reclamation Service Center

and facilities. The inspections also included radiological surveys of both the mine yard area and the lower adit area.

Based on the information gathered, the following recommendations are made in order to properly abandon and reclaim the Orphan Mine site:

1. HEADFRAME AND HOIST. If the decision is made by Park Service officials to remove the headframe, it may be possible to offer the headframe and related hoisting equipment to a mining company, free of charge, on the condition that the mining company dismantles and removes the headframe and hoist at its own expense and within a specific time. This recommendation is made because it is felt by the BLM that the headframe and hoist has definite salvage value even during a period where the mining economy is depressed which the country is experiencing now. Any implementation of this recommendation should be done under close Park supervision to ensure timely removal.

However, if this recommendation proves to be impractical or unfeasible, it is recommended that the headframe be either dismantled and properly disposed of by burial, disposed of as scrap metal, or retained by the Park for future internal use as structural steel. Before the second and third options can be considered for implementation, the structure will need to be checked for any radiological contamination.

2. STRUCTURES. All corrugated metal structures should be dismantled and properly disposed of at an authorized burial site. Here again, in order to minimize the cost of removal to the Park Service, it may be possible to offer the corrugated metal to a scrap dealer if he would dismantle and remove the material at his own expense and if the material is not contaminated. The wooden frames, a concrete block wall, and a small concrete block addition to one of the buildings will have no salvage value and, therefore, will still have to be disposed of by burial.

Other structures, such as the water tanks and septic tanks, should be dismantled and properly disposed of at an authorized burial site. Miscellaneous structures, such as the fence and power poles, should also be dismantled and properly disposed of. These miscellaneous structures may have enough salvage value to entice a scrap dealer to remove the structures or may be useful to the Park for internal use. Miscellaneous structures and equipment located just off the edge of the rim should also be removed and properly disposed of by burial. The fence should remain in place until the site work recommended in Number 4 is ready to begin.

The structures, including the bunkhouses and the return tramway tower, located in the adit area have no salvage value because of their remote location and should be dismantled and disposed of by depositing into the open subsidence hole. This recommendation would be more cost effective than transferring the material by

helicopter to the South Rim before disposing the material at a burial site. There would be no impact to the Park from this recommendation because of the depth of the open subsidence hole.

3. **EQUIPMENT AND MATERIAL.** Equipment, other than the hoist discussed under Recommendation Number 1, should be removed and properly buried. One possible exception would be the compressor which may have some residual salvage value. This particular piece of equipment could also be offered, as part of any agreement for removing the headframe, as an additional incentive. No other equipment appears to have any salvage value.

However, because of the approximate age of the electrical transformers identified earlier, it is recommended that they be checked to determine if any of them may contain the hazardous chemical PCB (polychlorinated biphenyl) which was used as an electrical insulator. If underground fuel tanks still exist within the mine yard, their location should be accurately determined prior to any work commencing under Recommendation Number 4. The tanks will need to be uncovered and removed to a proper disposal site after verifying that the tanks no longer contain fuel. Other than these special precautions, the disposing of all other equipment should pose no special handling problems.

Mine related materials, such as the ventilation ducts and water pipes, have no salvage value and should be removed and properly buried. The bulk of the miscellaneous material consists of trash and debris and should have no special handling problems or precautions to be aware of.

The equipment and material, including debris, located in and around the lower adit area should be disposed of by depositing into the open subsidence hole which will be more cost effective than the use of a helicopter to remove the items.

4. **SHAFT AND CONTAMINATED MATERIALS.** Based upon the BLM radiological survey, the area in and around the mine yard is emitting low levels of radiation. Two explanations of the source of the low level radiation would be that material from the mine was used as fill when the mine yard site was being prepared and/or the random scattering of uranium ore by men and equipment during the active mining periods. In addition, it appears that low level radioactive material was transported by wind and water action to the Park lands adjacent to the fenced mine yard. Please refer to Figure 4 which shows the area, approximately 5.6 acres in size, where contamination has occurred. Figure 5 is a sketch copy of the mine yard area which shows the readings taken during the radiological survey.

In order to minimize the exposure from this hazard, it is recommended that the area showing radiation levels greater than the amount specified by Part 20 of Title 10 of the Code of Federal

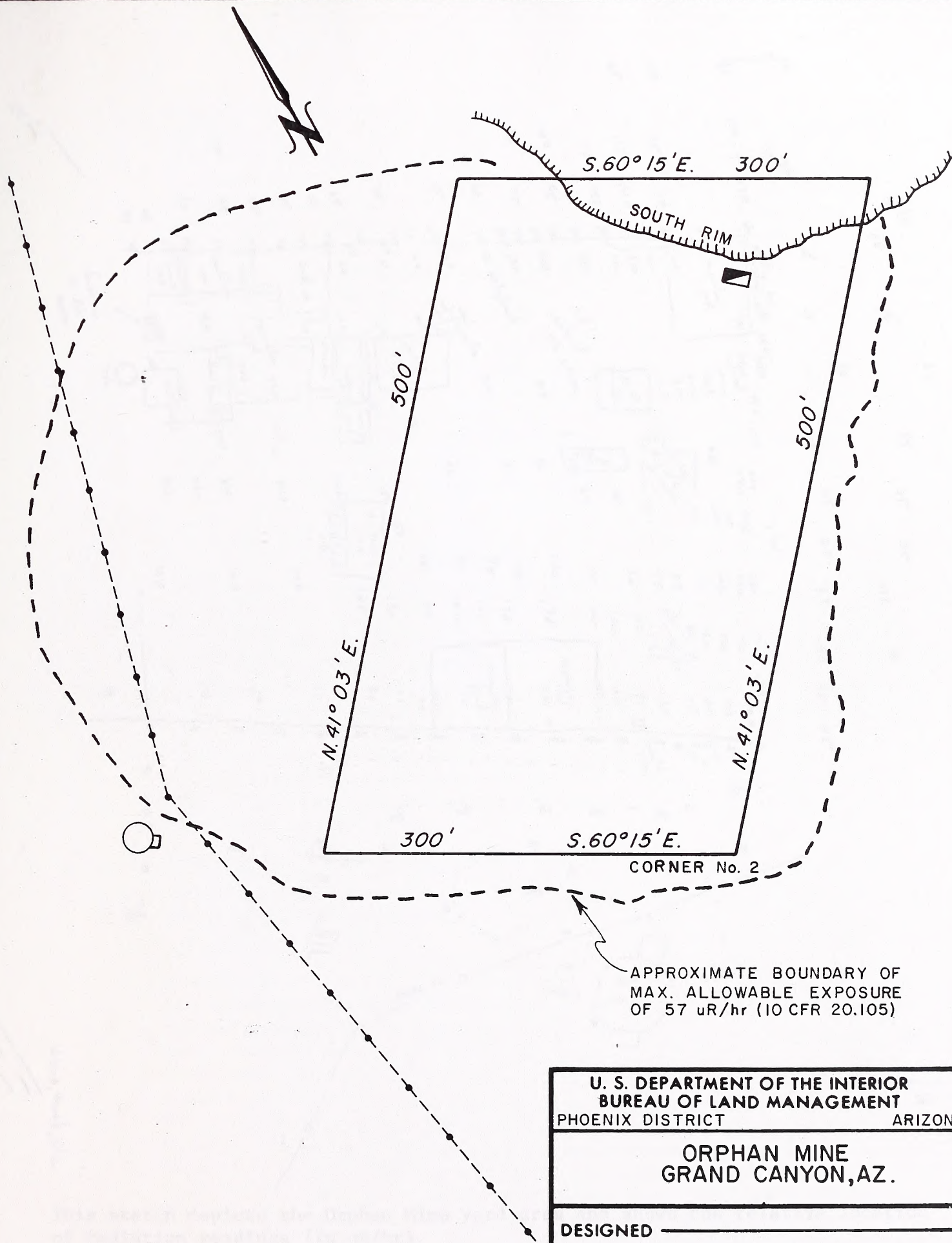
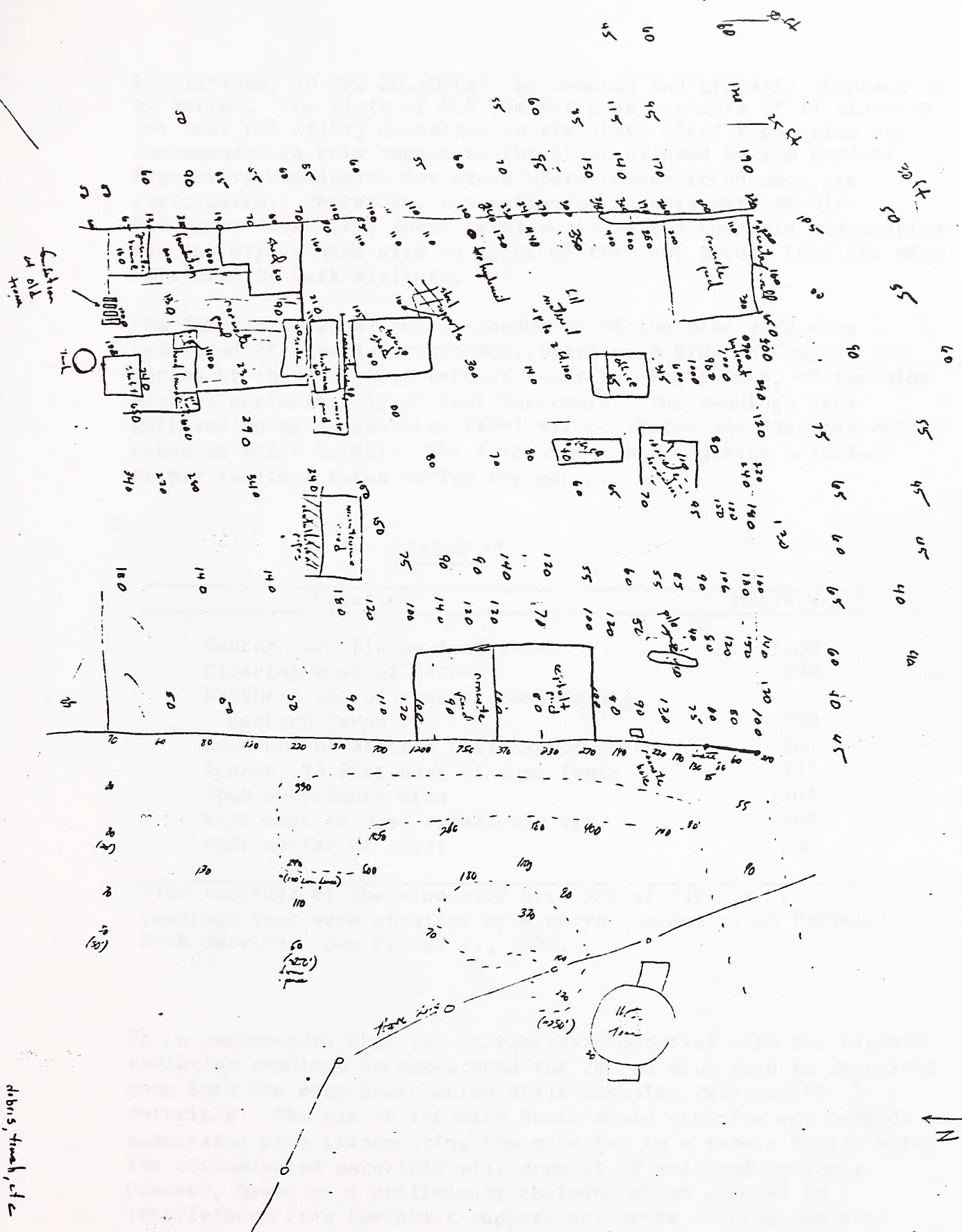


FIGURE - 4

U. S. DEPARTMENT OF THE INTERIOR BUREAU OF LAND MANAGEMENT PHOENIX DISTRICT ARIZONA	
ORPHAN MINE GRAND CANYON, AZ.	
DESIGNED _____	
REVIEWED _____	
APPROVED _____	
DRAWN R.G.F.	SCALE 1"=100'
DATE APRIL 1986	SHEET 1 OF 1
DRAWING NO.	

Not to Scale



This sketch depicts the Orphan Mine yard area and shows the relative location of radiation readings (in uR/hr).

FIGURE 5

Orphan Mine
5-15-85

Regulations, 10 CFR 20.105(a), be removed and properly disposed of by burial. The limit of 0.5 rem per year exposure or 57 microrem per hour (57 uR/hr) contained in the above cited regulation and recommended in this report is the limit allowed by the Nuclear Regulatory Commission for areas where unrestricted uses are anticipated. Therefore, the achieving of this permissible radiation level or a lower level would be a reasonable expectation for the Orphan Mine site in light of the easy access into the mine yard area by Park visitors.

The BLM radiological survey conducted of the mine yard area consisted of parallel traverses, based upon Brunton Compass and pacing of the distances between meter reading points, of the mine yard at approximately 25 foot intervals. The readings were gathered using an Eberline PRM-7 Micro R meter and readings were taken at waist height. The following table contains selected sample readings taken during the survey.

TABLE 1*

Location	Micro R/hr.
Eastern ore bin at headframe	1100
Clearing west of fence	800
Northern end of concrete wall along eastern fence	380
East end of stacked ventilation ducts	240
Approx. 25 feet east of east fence	115
Open subsidence area	1100
Adit next to open subsidence area	3200
West collar of shaft	650

*The readings of the mine yard area are similiar to the readings that were obtained by a survey conducted by National Park Service. See Fiano, J., 1982.

It is recommended that the contaminated material with the highest radiation readings in and around the fenced mine yard be deposited down into the mine shaft which still contains radioactive materials. The use of the mine shaft would minimize any hazards associated with transporting the material to a remote burial site. The contaminated materials will consist of soil and concrete. However, based on a preliminary estimate which assumes no interference from the shaft support structure or from any mine support equipment such as air and water lines, the total volume of contaminated material will exceed the volume of the mine shaft by 100 to 200%. Therefore, the material with lower radiation readings will either have to be transported to a remote burial site or buried on site. Contaminated material located off the edge of the rim should also be recovered but may be difficult to reach with

mechanical equipment and may have to be left in place if the volume is small or the amount of disturbance outweighs the benefits.

The work of gathering the contaminated materials would be accomplished by a combined dozer and frontend loader operation. It is recommended that dust control measures (water spray) be used during the removal of contaminated materials, so that additional radioactive material is not transported by the wind to adjacent Park lands. In order to minimize the amount of uncontaminated material that is removed with the contaminated material, it is recommended that radiation readings or soil samples be taken as the work progresses. Due to the shallow depth of the contaminated material in some locations, the monitoring of the work must be done on a continuous basis and not on an intermittent basis. Therefore, properly trained personnel with the necessary radiation and/or soil sampling equipment should be onsite at all times during the removal operation.

Once the shaft has been filled to within six feet of the surface with contaminated material, the shaft should be sealed with a 4 foot concrete cap and then 2 feet of top soil. The concrete cap should be so designed that it is anchored into the sides of the shaft so that future settling of the contaminated material will not cause the cap to settle. In addition to isolating the contaminated material, the capping of the shaft will prevent further escape of radon gas which is also a health hazard.

After the mine yard site has had all of the contaminated materials removed, it is recommended that the site be backfilled with topsoil and contoured into the natural terrain. A suitable vegetative cover should be established in order to minimize erosion of the site.

5. SUBSIDENCE AREA. Due to the remoteness and size of the open hole that was created when the surface subsided into the old underground mine workings, the only practical recommendation to reclaim the area would be to construct a heavy duty chain link fence so that wildlife and hikers would be kept a safe distance from the subsidence hole. The location of the fence must take into account that the top of the hole has not yet completely stabilized. Danger and radiation warning signs should be posted on the fence to warn Park visitors who may venture into the area of the dangerous situation.
6. ADITS AND RAISES. All adits and raises should be sealed to prevent entry into the underground mine workings. Sealing these mine entries can be accomplished by either the construction of a concrete seal or the use of an explosive charge to blast in the sides of the entry. This recommendation includes the adit at the open subsidence hole even though it will be located within the fenced off area identified in Recommendation Number 5. The sealing of this adit is necessary because it would prevent someone from

climbing over the fence and entering the underground mine workings.

The adit that has been partially bulkheaded off should be blasted shut in order to prevent the buildup of water in the adit. Since the water is naturally occurring in the Coconino Sandstone, the destruction of the bulkhead will allow the water to seep down and dissipate over the naturally occurring outslope of the Hermit Shale at that location. The quality of the water is within acceptable standards except for the detectable levels of dissolved uranium, radium-226, and radon-222. Results of the water sample taken from the pool are shown in Tables 2 and 3, however, additional sampling of the water will be needed to determine any health impacts to consumption by humans and wildlife. It may be unwise to completely seal off the adit because of the possibility of the seal failing at a future date.

7. TRAMWAY. Due to the type of construction materials used on the tramway towers, natural deterioration will eventually cause the towers to collapse. Access to the intermediate tramway towers will be more difficult than the lower adit area. For this reason, it will be cost effective to leave the intermediate towers in place.

However, the decision can be made to remove the tramway towers. This option will require extensive helicopter support and a large labor force to dismantle and remove the intermediate tramway towers and to gather up the cable which will probably have to be cut into shorter lengths in order to be handled by the helicopter. The structural material of the towers, after dismantling, and the cable may either be airlifted to the South Rim for disposal at a remote site or to the lower adit area for disposal in the open subsidence hole. The final method of disposal can only be determined after an evaluation of the ability of the helicopter to safely deposit the material directly into the open subsidence hole or adjacent to the hole. Such factors as wind conditions or steepness of the terrain will have to be taken into account.

The concrete foundations of the tramway towers should be left in place because of the effort that will be needed and the disturbance that may be caused in order to remove the imbedded concrete. These foundations would have no impact to the Park if they were left in place.

CONCLUSION

The abandonment and reclamation of the Orphan Mine site should be implemented by the National Park Service in order to minimize the residual hazards to Park visitors from the mining operation. However, the reclamation of the mine need not be the highest priority of the Park Service because of the short exposure time experienced by Park visitors. The reclamation recommendations should be implemented as the Park Service budget and resources will allow without disrupting the normal operation of the Park.

INORGANIC CHEMICAL ANALYSIS REPORTING FORM

Personnel from the Bureau of Land Management will be available to discuss any aspect of this report prior to the finalization of the Orphan Mine reclamation plan by the National Park Service.

ARIZONA TESTING LABORATORIES

1000 North Central Avenue
Phoenix, Arizona 85004

DATE OF ANALYSIS: 10/10/80

ANALYST: J. J. ...

CLAS	WELL
FLUID	OTHER
OTHER (SPECIFY)	

NO. OF SAMPLES	1
DATE OF ANALYSIS	10/10/80
ANALYST	J. J. ...

ANALYST	ANALYST	ANALYST	ANALYST	ANALYST	ANALYST
1	2	3	4	5	6
7	8	9	10	11	12
13	14	15	16	17	18
19	20	21	22	23	24
25	26	27	28	29	30
31	32	33	34	35	36
37	38	39	40	41	42
43	44	45	46	47	48
49	50	51	52	53	54
55	56	57	58	59	60
61	62	63	64	65	66
67	68	69	70	71	72
73	74	75	76	77	78
79	80	81	82	83	84
85	86	87	88	89	90
91	92	93	94	95	96
97	98	99	100	101	102
103	104	105	106	107	108
109	110	111	112	113	114
115	116	117	118	119	120
121	122	123	124	125	126
127	128	129	130	131	132
133	134	135	136	137	138
139	140	141	142	143	144
145	146	147	148	149	150
151	152	153	154	155	156
157	158	159	160	161	162
163	164	165	166	167	168
169	170	171	172	173	174
175	176	177	178	179	180
181	182	183	184	185	186
187	188	189	190	191	192
193	194	195	196	197	198
199	200	201	202	203	204
205	206	207	208	209	210
211	212	213	214	215	216
217	218	219	220	221	222
223	224	225	226	227	228
229	230	231	232	233	234
235	236	237	238	239	240
241	242	243	244	245	246
247	248	249	250	251	252
253	254	255	256	257	258
259	260	261	262	263	264
265	266	267	268	269	270
271	272	273	274	275	276
277	278	279	280	281	282
283	284	285	286	287	288
289	290	291	292	293	294
295	296	297	298	299	300
301	302	303	304	305	306
307	308	309	310	311	312
313	314	315	316	317	318
319	320	321	322	323	324
325	326	327	328	329	330
331	332	333	334	335	336
337	338	339	340	341	342
343	344	345	346	347	348
349	350	351	352	353	354
355	356	357	358	359	360
361	362	363	364	365	366
367	368	369	370	371	372
373	374	375	376	377	378
379	380	381	382	383	384
385	386	387	388	389	390
391	392	393	394	395	396
397	398	399	400	401	402
403	404	405	406	407	408
409	410	411	412	413	414
415	416	417	418	419	420
421	422	423	424	425	426
427	428	429	430	431	432
433	434	435	436	437	438
439	440	441	442	443	444
445	446	447	448	449	450
451	452	453	454	455	456
457	458	459	460	461	462
463	464	465	466	467	468
469	470	471	472	473	474
475	476	477	478	479	480
481	482	483	484	485	486
487	488	489	490	491	492
493	494	495	496	497	498
499	500	501	502	503	504
505	506	507	508	509	510
511	512	513	514	515	516
517	518	519	520	521	522
523	524	525	526	527	528
529	530	531	532	533	534
535	536	537	538	539	540
541	542	543	544	545	546
547	548	549	550	551	552
553	554	555	556	557	558
559	560	561	562	563	564
565	566	567	568	569	570
571	572	573	574	575	576
577	578	579	580	581	582
583	584	585	586	587	588
589	590	591	592	593	594
595	596	597	598	599	600
601	602	603	604	605	606
607	608	609	610	611	612
613	614	615	616	617	618
619	620	621	622	623	624
625	626	627	628	629	630
631	632	633	634	635	636
637	638	639	640	641	642
643	644	645	646	647	648
649	650	651	652	653	654
655	656	657	658	659	660
661	662	663	664	665	666
667	668	669	670	671	672
673	674	675	676	677	678
679	680	681	682	683	684
685	686	687	688	689	690
691	692	693	694	695	696
697	698	699	700	701	702
703	704	705	706	707	708
709	710	711	712	713	714
715	716	717	718	719	720
721	722	723	724	725	726
727	728	729	730	731	732
733	734	735	736	737	738
739	740	741	742	743	744
745	746	747	748	749	750
751	752	753	754	755	756
757	758	759	760	761	762
763	764	765	766	767	768
769	770	771	772	773	774
775	776	777	778	779	780
781	782	783	784	785	786
787	788	789	790	791	792
793	794	795	796	797	798
799	800	801	802	803	804
805	806	807	808	809	810
811	812	813	814	815	816
817	818	819	820	821	822
823	824	825	826	827	828
829	830	831	832	833	834
835	836	837	838	839	840
841	842	843	844	845	846
847	848	849	850	851	852
853	854	855	856	857	858
859	860	861	862	863	864
865	866	867	868	869	870
871	872	873	874	875	876
877	878	879	880	881	882
883	884	885	886	887	888
889	890	891	892	893	894
895	896	897	898	899	900
901	902	903	904	905	906
907	908	909	910	911	912
913	914	915	916	917	918
919	920	921	922	923	924
925	926	927	928	929	930
931	932	933	934	935	936
937	938	939	940	941	942
943	944	945	946	947	948
949	950	951	952	953	954
955	956	957	958	959	960
961	962	963	964	965	966
967	968	969	970	971	972
973	974	975	976	977	978
979	980	981	982	983	984
985	986	987	988	989	990
991	992	993	994	995	996
997	998	999	1000	1001	1002

RECEIVED
OCT 24 1980
U.S. BUREAU OF LAND MANAGEMENT
PHOENIX, ARIZONA

206500
SPECIMEN NO

5-16-85

DATE REC'D _____

PWS ID NO.						
0	4					

LAB ID NO	0	0	0	0	2
-----------------	---	---	---	---	---

42-46

817 West Madison Street
Phoenix, AZ 85007 (602) 254-6181

SAMPLE DATE					
Mo.		Day		Yr.	

SAMPLE				
Type	Time (Hrs.)			
37	38-41			

SAMPLING POINT—WELL NO. OR EXACT LOCATION

Orphan #2

U.S. Bureau of Land Mangagement
Mr. Moon Hom
2015 West Deer Valley Road
Phoenix, Arizona 85027

SAMPLE APPEARANCE

Clear

Turbid

Other (comment)

**WATER SUPPLY
SOURCE**

Well

Surface

SAMPLE TYPE CODES
C - Check Sample
D - Regular Distribution Sample
P - Plant Tap Sample
R - Raw Water Sample
S - Special Sample

SAMPLER'S COMMENTS OR INSTRUCTIONS

CONTAMINANT CODE			
1	0	0	5
1	0	1	0
1	0	1	5
1	0	2	0
1	0	2	5
1	0	3	0
1	0	3	5
1	0	4	0
1	0	4	5
1	0	5	0
1	9	2	7
1	0	1	6
1	0	1	7
1	0	2	2
1	9	1	5
1	0	2	8
1	0	3	1
1	0	3	2
1	9	2	5
1	0	5	2
1	0	5	5
1	9	3	0
1	0	9	5

ANALYSIS METHOD		
1	0	1
1	0	1
1	0	1
1	0	1
1	0	7
1	0	1
1	0	3
1	0	9
1	0	1
1	0	1
1	4	9
1	0	1
1	4	9
1	0	1
1	4	1
1	0	1
1	0	1
1	0	1
1	3	5
1	0	1
1	3	7
1	3	9
1	0	1

CONTAMINANT NAME	(MCL)
Arsenic	(0.05)
Barium	(1.)
Cadmium	(0.010)
Chromium	(0.05)
Fluoride	(1.4-2.0)
Lead	(0.05)
Mercury	(.002)
Nitrates (N)	(10.)
Selenium	(0.01)
Silver	(0.05)
Alkalinity	
Calcium	
Chloride	
Copper	
Hardness	
Iron	
Magnesium	
Manganese	
pH	
Sodium	
Sulfate	
TDS	
Zinc	

ANALYSIS RESULTS (mg/l)	
	0.09
<	0.5
<	0.005
<	0.01
<	0.02
<	0.001
	0.6
<	0.005
<	0.02
<	0.05
<	0.1
<	0.05
<	0.05

EXCEEDS

Pursuant to R9-8-223
check samples are
REQUIRED for ANY
and ALL contaminant(s)
checked in the exceeds
column.

LOCATION
CODE

28-30

RECEIVED

BLM, PHOENIX DIST. OFF.
PHOENIX, ARIZONA

JUN 24 1985

AM **PM**

7	8	9	10	11	12	1	2	3	4	5	6
---	---	---	----	----	----	---	---	---	---	---	---

10-13

14-16

17-20

COMMENTS

TABLE 2

ANALYST

ANALYSIS DATE

Mo.		Day		Yr.	
0	6	2	1	8	5

Page 16



Controls for Environmental Pollution, Inc.

P.O. BOX 5351

OUT OF STATE 800/545-2188

LAB # 85-05-443

PAGE 1

RECEIVED: 05/31/85

CEP, Inc.

REPORT

06/14/85 16:59:12

REPORT Bureau of Land Management
TO 2015 W. Deer Valley Road
Phoenix, AZ 85027

PREPARED Controls for Environmental
BY Pollution, Inc.
1925 Rosina Street
Santa Fe, NM 87502

ATTEN Moon Hom

PHONE (505) 982-9841

CLIENT BUREAU LAND SAMPLES 1
COMPANY Bureau of Land Management
FACILITY Phoenix District Office

WORK ID Environmental

TAKEN

TRANS Mail

TYPE Water

P.O. # A-17643-MC

INVOICE under separate cover

SAMPLE IDENTIFICATION

01 Orphan #1

CEP, Inc.

TEST CODES and NAMES used on this report

FU 1 Total Uranium
RA226W Radium-226
RADON1 Radon-222



Controls for Environmental Pollution, Inc.

P.O. BOX 5351 • Santa Fe, New Mexico 87502

IN STATE 505/982-9841

OUT OF STATE 800/545-2188

LAB # 85-05-443

PAGE 2

SAMPLE IDENTIFICATION

Orphan #1

DATE COLLECTED
not specified

TYPE OF ANALYSIS

Total Uranium
Radium-226
Radon-222

mq/liter

0.620

17.9±2.0 (pCi/liter)
1.19±0.40 (pCi/liter)

BIBLIOGRAPHY

- Day, G. J., J. G. Sepulveda, and R. J. Jackson. Report of Radiation Survey--Orphan Mine; Grand Canyon National Park, Arizona. U. S. Mine Safety and Health Administration, Subdistrict Office, Phoenix, AZ.; December 14, 1981.
- Fiano, J. "Monitoring Radon Gas at Grand Canyon." U. S. National Park Service, Grand Canyon National Park, Grand Canyon, AZ.; October 26, 1982.
- Granger, H. C. and R. B. Raup. Reconnaissance Study of Uranium Deposits in Arizona. U. S. Geological Survey Bulletin 1147-A; 1962.
- Lane, T. "Field Engineers Report--Orphan Mine." Arizona Department of Mineral Resources, Phoenix, AZ.; September 4, 1959.
- Magleby, D. N. Orphan Lode Uranium Mine, Grand Canyon, Arizona. U. S. Atomic Energy Commission, Grand Junction, CO. Report TM-134; March 1961.
- Scarborough, R. B. Radioactive Occurrences and Uranium Production in Arizona. U. S. Department of Energy, Grand Junction, CO. Open-file Report GJBX-I43(81); March 1981.
- Tetreault, G. "Report on the Orphan Mine--Grand Canyon National Park, Arizona." U. S. Bureau of Land Management, Albuquerque, NM. April 1986.



PHOTO #1: The view of the Orphan Mine facilities located on the South Rim of the Grand Canyon. The photo is taken from the Powell Memorial.



PHOTO #2: A view of the Orphan Mine facilities located on the South Rim. The photo was taken from the mine yard gate and is looking to the North.



PHOTO #3: Another view of the Orphan Mine facilities on the South Rim. This was taken, looking to the south, from the foundation of the aerial tramway.



PHOTO #4: This photo show the lower adit area which includes the open subsidence hole and the lower aerial tramway tower.

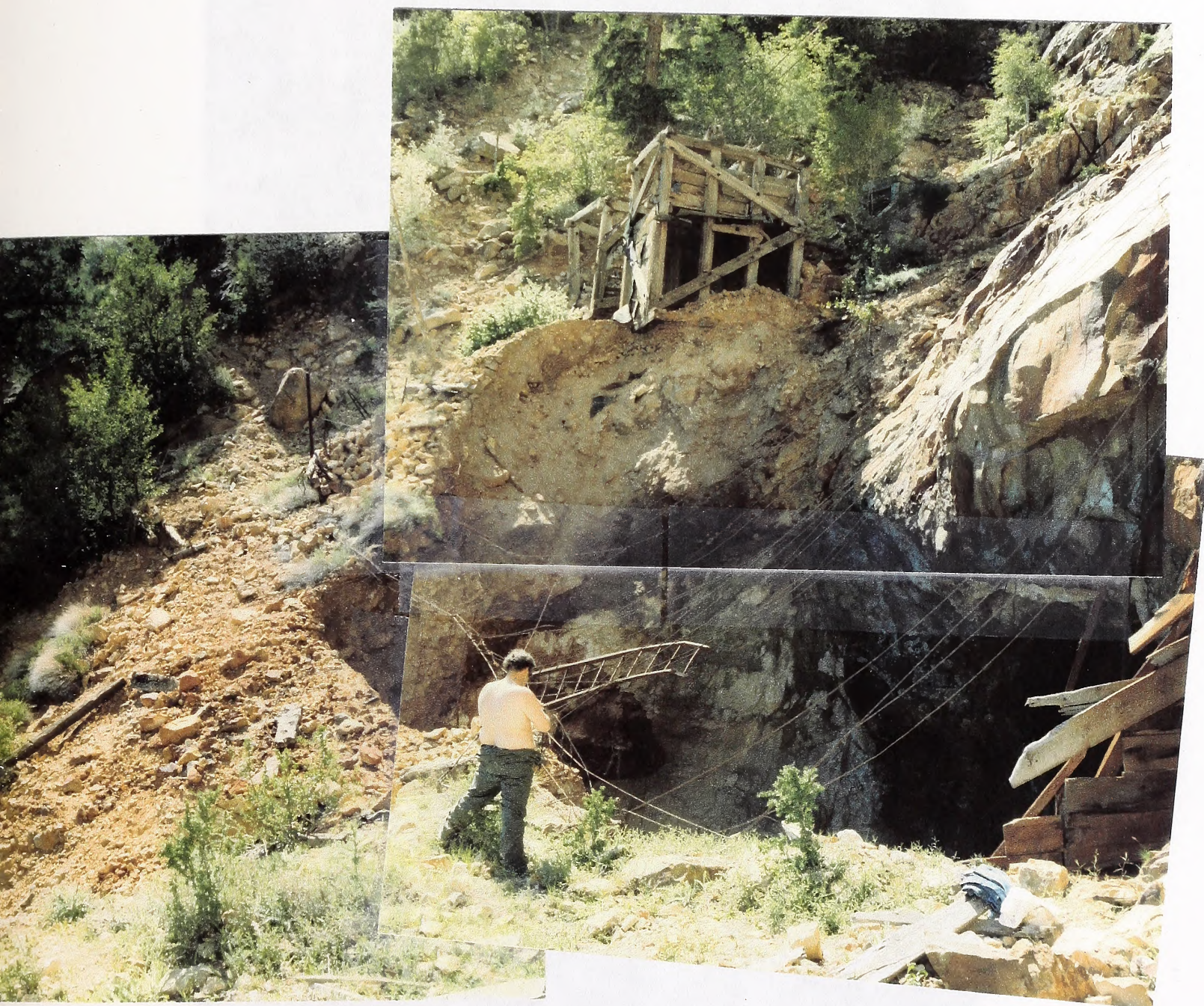


PHOTO #5: This photo is a closeup view of the open subsidence hole and low aerial tramway tower shown in Photo #4. The cables and wooden planks were an apparent attempt to isolate the open hole from men and equipment in the area.

5-14-85



PHOTO #6: A view of the bunkhouses located at the lower adit area of the Orphan Mine. The ledge that these structures sit on is located at the left of top center of Photo #4.



PHOTO #7: This photo is looking back to the area where Photo #6 was taken. Two adits, with the near one partially bulkheaded, are seen in this photo.



PHOTO #8: A closer view of the partially bulkheaded adit seen in Photo #7.



PHOTO #9: A view of the two intermediate aerial tramway towers from the lower adit area.

